Claim Amendments

This listing of the claims will replace all prior versions, and listings, of claims in the application:

Claim 1 (currently amended): A diaphragm pump for delivering liquid reducing agent to an exhaust-gas aftertreatment installation of an internal combustion engine, comprising:

a pump casing having a base and defining an inlet passage and an outlet passage;

a central support body disposed in said casing;

a spring disposed in said casing and imparting a force against said central support body;

a pump diaphragm disposed in said casing to define a reducing agent chamber thereabove with respect to said base and having:

two limit positions;

a first side secured to said pump casing; and

a second side secured to said central support body;

an electromagnet disposed at said base and operatively connected to said pump diaphragm to move said pump diaphragm to and fro with ~~respect to~~ said central support body between said limit positions counter to said force of said spring upon actuation of said electromagnet;

a non-return inlet valve fluidically connected to said inlet passage for supplying reducing agent to said reducing agent chamber;

a non-return outlet valve fluidically connected to said outlet passage for discharging the reducing agent; and

a pressure sensor connected to said pump casing and having a pressure sensor diaphragm, said pressure sensor diaphragm ~~recording~~ sensing a pressure of the reducing agent in said pump casing above said pump diaphragm and being disposed to have said pump diaphragm absorb an increase in volume of the reducing agent when the reducing agent freezes inside said reducing agent chamber by said pump diaphragm deviating counter to said force of said spring;

said pressure sensor and said central support body defining a gap therebetween, said gap serving as a flow connection between said inlet passage and said outlet passage.

Claim 2 (currently amended): The diaphragm pump according to claim 1, wherein:

said electromagnet has an armature plate;

said central support body has:

an end facing said electromagnet; and

a drive shaft at said end facing said electromagnet; and

said armature plate is disposed at ~~said end of~~ said drive shaft.

Claim 3 (original): The diaphragm pump according to claim 2, wherein said armature plate is connected to said drive shaft by a connection selected from the group consisting of an adhesive bond, a weld, a press-fit, and a screw connection.

Claim 4 (withdrawn): The diaphragm pump according to claim 1, wherein:

said pressure sensor defines a cup-shaped recess;

said central support body has a cylindrical end remote from said electromagnet;

said cylindrical end has a surface remote from said electromagnet;

said cylindrical end projects into said cup-shaped recess to form a gap between said recess and said surface; and

said gap fluidically connects said inlet passage to said outlet passage.

Claim 5 (withdrawn): The diaphragm pump according to claim 1, wherein:

said support body has a flange;

said second side of said pump diaphragm is fixedly connected to said flange; and

said first side is fixedly connected to said pump casing.

Claim 6 (withdrawn): The diaphragm pump according to claim 1, wherein said casing is of a metallic material having high thermal conductivity.

Claim 7 (withdrawn): The diaphragm pump according to claim 6, wherein said casing is of aluminum.

Claim 8 (withdrawn): The diaphragm pump according to claim 1, wherein said casing is of aluminum.

Claim 9 (withdrawn): The diaphragm pump according to claim 1, wherein said spring is disposed between said base and said central support body.

Claim 10 (withdrawn): The diaphragm pump according to claim 1, wherein said spring imposes said force against said central support body in a direction away from said base.

Claim 11 (currently amended): A diaphragm pump for delivering liquid reducing agent to an exhaust-gas aftertreatment installation of an internal combustion engine, comprising:

a pump casing having a base and defining an inlet passage and an outlet passage;

a central support body disposed in said casing;

a spring disposed in said casing and imparting a force against said central support body;

a pump diaphragm disposed in said casing to define a reducing agent chamber thereabove with respect to said base and having:

two limit positions;

a first side secured to said pump casing; and

a second side secured to said central support body;

an electromagnet disposed at said base and operatively connected to said central support body to move said central support body and, thereby, said pump diaphragm to and fro between said limit positions counter to said force of said spring upon actuation of said electromagnet;

a non-return inlet valve fluidically connected to said inlet passage for supplying reducing agent to said reducing agent chamber;

a non-return outlet valve fluidically connected to said outlet passage for discharging the reducing agent; and

a pressure sensor connected to said pump casing and having a pressure sensor diaphragm, said pressure sensor diaphragm ~~recording~~ sensing a pressure of the reducing agent in said reducing agent chamber, said pump diaphragm deviating counter to said force of said spring to absorb an increase in volume of the reducing agent when the reducing agent freezes inside said reducing agent chamber;

said pressure sensor and said central support body defining a gap therebetween, said gap serving as a flow connection between said inlet passage and said outlet passage.

Claim 12 (currently amended): The diaphragm pump according to claim 1, wherein:

said electromagnet has an armature plate;

said central support body has:

an end facing said electromagnet; and

a drive shaft at said end facing said electromagnet; and

said armature plate is disposed at ~~said end of~~ said drive shaft.

Claim 13 (original): The diaphragm pump according to claim 12, wherein said armature plate is connected to said drive shaft by a connection selected from the group consisting of an adhesive bond, a weld, a press-fit, and a screw connection.

Claim 14 (withdrawn): The diaphragm pump according to claim 11, wherein:

said pressure sensor defines a cup-shaped recess;

said central support body has a cylindrical end remote from said electromagnet;

said cylindrical end has a surface remote from said electromagnet;

said cylindrical end projects into said cup-shaped recess to form a gap between said recess and said surface; and

said gap fluidically connects said inlet passage to said outlet passage.

Claim 15 (withdrawn): The diaphragm pump according to claim 11, wherein:

said support body has a flange;

said second side of said pump diaphragm is fixedly connected to said flange; and

said first side is fixedly connected to said pump casing.

Claim 16 (withdrawn): The diaphragm pump according to claim 11, wherein said casing is of a metallic material having high thermal conductivity.

Claim 17 (withdrawn): The diaphragm pump according to claim 16, wherein said casing is of aluminum.

Claim 18 (withdrawn): The diaphragm pump according to claim 11, wherein said casing is of aluminum.

Claim 19 (withdrawn): The diaphragm pump according to claim 11, wherein said spring is disposed between said base and said central support body.

Claim 20 (withdrawn): The diaphragm pump according to claim 11, wherein said spring imposes said force against said central support body in a direction away from said base.

Drawing Amendments

The attached sheet of drawings includes changes to Fig. 2. This sheet which includes Fig. 2, replaces the original sheet including Fig. 2. In Fig. 2, crosshatching has been added to the sensor and sensor diaphragm.

Please approve the drawing changes that are marked in red on the accompanying "Annotated Sheet Showing Changes" of Fig. 2. A formal "Replacement Sheet" of amended Fig. 2 is also enclosed.

Attachments: Replacement Sheet
Annotated Sheet Showing Changes